FISHING FOR PROFIT • No. 2

picking a prop

Canada

Facing the problem

This brochure is designed to introduce Atlantic Coast fishermen with the basic principles of propeller design and performance. It is in response to a growing awareness that tremendous losses are incurred each year by fishermen operating with inefficient propellers.

Read carefully. The savings in time, trouble, fuel and money may be considerable.

It's an involved project. This pamphlet can but skim the surface. For more information or if you have some cost cutting suggestions of your own, please contact us at any of the following addresses.

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DISPONSIBLE EN FRANCAIS

Choosing a propeller

Choosing a propeller for a fishing vessel is not an easy decision. Many things must be considered — the design of the hull, the power of the engine and the conditions under which the vessel will operate. Then there's the choice of material the propeller is made of, it's shape, the thickness and number of blades. Decisions must also be made as to whether devices such as nozzles should be installed to further improve performance.

Integrating all these variables is really a job for the specialist, as it involves rather complicated mathematical calculations. Yet there is much that a fisherman can and should know. It's his vessel. It's his livelihood.

All too often, propeller selection is made far too lightly. This has resulted in a tremendous loss to fishermen. A propeller that's ill-suited to the vessel results in poor operating efficiency and a waste of fuel. Often it causes excessive noise and vibration. Frequently it leads to a deterioration of the blade itself and sometimes to the engine.

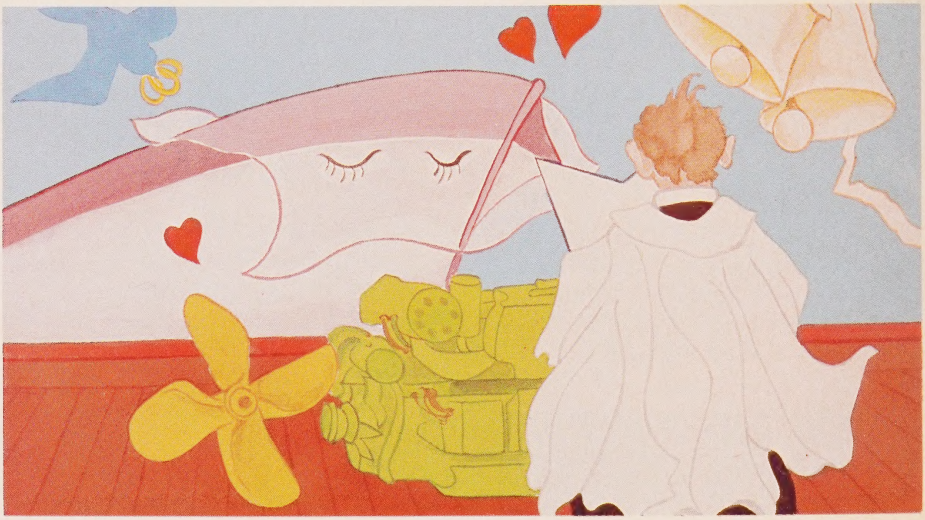
It all adds up to a needless loss of income and fishing time. This booklet is designed to help correct this situation by familiarizing fishermen with some of the fundamentals of propulsion — so that he will make sure that he gets the propeller that is best suited to his vessel and to his particular fishing needs.

The perfect propeller

Don't expect to find the "perfect" propeller. It doesn't exist. There is no way a propeller, particularly a propeller of fixed pitch, can give maximum performance during all operating conditions. Each propeller has a design condition. That is, it is designed to fully absorb a certain power delivered from the engine at a certain speed. The propeller will still work when these conditions vary but there will a loss in efficiency.

So there is no way a propeller can satisfy all your operating needs all the time. A propulsion system that is ideal for dragging or pushing through ice for instance will be far from ideal for free running or gillnetting.

A happy marriage



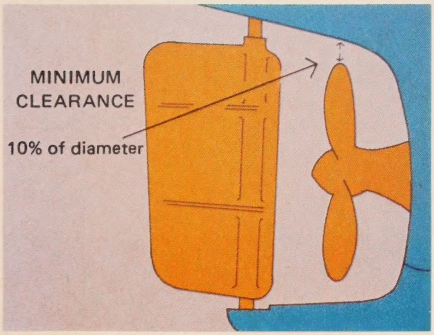
For most fishermen then it is a question of picking a propeller that is somewhere in between the extremes of the operating requirements. It's a matter of balancing all these needs — a matter of picking the best compromise — of making the best match between propeller, hull, engine and the way in which you intend to use your vessel.

It's advisable to consult with naval architects or marine engineers before deciding on a propeller. Such people are trained in making the calculations that will indicate the propeller you need. However, a propeller is a complex item to design. A naval architect must have all the necessary information about your vessel and engine and the way you intend to fish before he can start to work.

BASIC INFORMATION NEEDED

☐ Hull Lines ☐ Construction Details at Stern Including Aperture Opening ☐ Weight of Vessel and Normal Variation in Loading ☐ Type of Fishery Operation and Desired Speeds ☐ Rated Engine H.P. at Various R.P.M.'s ☐ Reduction Gear Ratio

Power, speed and propellers



Many fishing vessels on the Atlantic coast are greatly over-powered. Sometimes that extra power is genuinely needed. Often, however, it is based on a childish desire to pull ahead of the next fellow. And it rarely works, for speed is more closely related to the vessels length than it is to the engine horsepower. Also, if the engine cannot be fitted with a matching propeller, the result will be cavitation and a waste of fuel, not greater speed.

If you are satisfied that you do indeed need a better engine, check the aperture to see if there is room for a larger diameter propeller. Many vessels of the old longliner design have rather small apertures. If yours does, think twice about investing in a bigger engine. You could be wasting a lot of money.

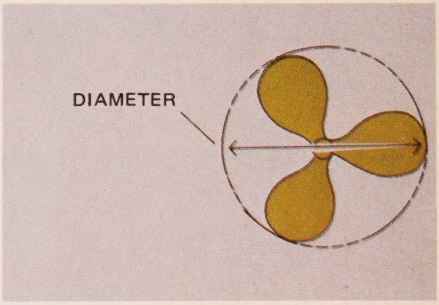
Increasing the diameter is one way of helping the propeller absorb the extra power of a bigger engine. There are other options however.

☐ Increasing the surface area of the blades ☐ Increasing the number of blades ☐ Changing reduction gear ☐ Installing a nozzle ☐ Installing a two pitch or variable-pitch propeller. Lets look at some of these options but first, back to the basics.

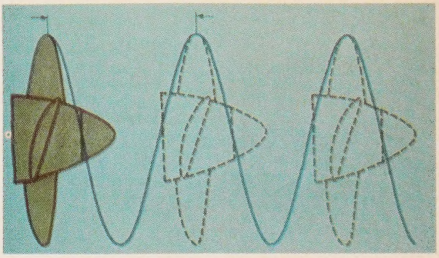
The basic variables

The main variables in the design of a propeller are diameter, pitch and surface area. The propeller's performance depends primarily upon these measurements and upon the R.P.M. delivered from the engine gear box.

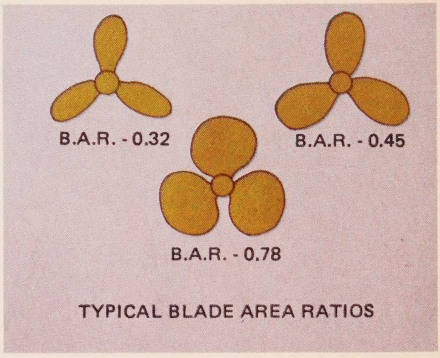
Diameter is the distance across a circle described by the rotating blades. As a general rule, as diameter increases the propeller efficiency increases. Therefore the propeller should be as large as possible, consistent with the required clearances and engine loadings.



Pitch is a theoretical figure for the distance the boat advances through one revolution of the propeller. Or, if you can think of the propeller as a screw, pitch is in the distance from thread to thread. The higher the inflow velocity of water to the propeller, the coarser the pitch should be. Fast, light vessels such as speed boats, for example, have coarsely pitched propellers.



The surface area of a propeller is usually referred to as its blade-area ratio. The figure represents the proportion of the propeller circle taken up by the blades.



TYPICAL BLADE AREA RATIOS

While smaller area blades are individually more efficient in performance, they can be overloaded more easily. Loading problems can be spread out and cavitation problems reduced by increasing the blade area ratio. Another way is simply to increase the number of blades. For single screw propellers behind a stern post an odd number of blades is usually preferable.

Cavitation

If your blades appear pitted and eaten away, your vessel is likely suffering from the number one propeller disease — cavitation.

It means the blades are not able to absorb the full power delivered by the engine. The pressure difference between the front face and the after face of the blades becomes too high per square inch. The result — inefficient performance and propeller damage.

Cavitation occurs on the blade faces or at the propeller tips but it's the face cavitation which is most damaging.

Essentially, the suction pressures on the forward face of the blade becomes so low that bubbles begin to appear. In effect, the water begins to boil. As the blade rotates these bubbles dash across to higher pressure areas and collapse, lifting away tiny pieces of metal.

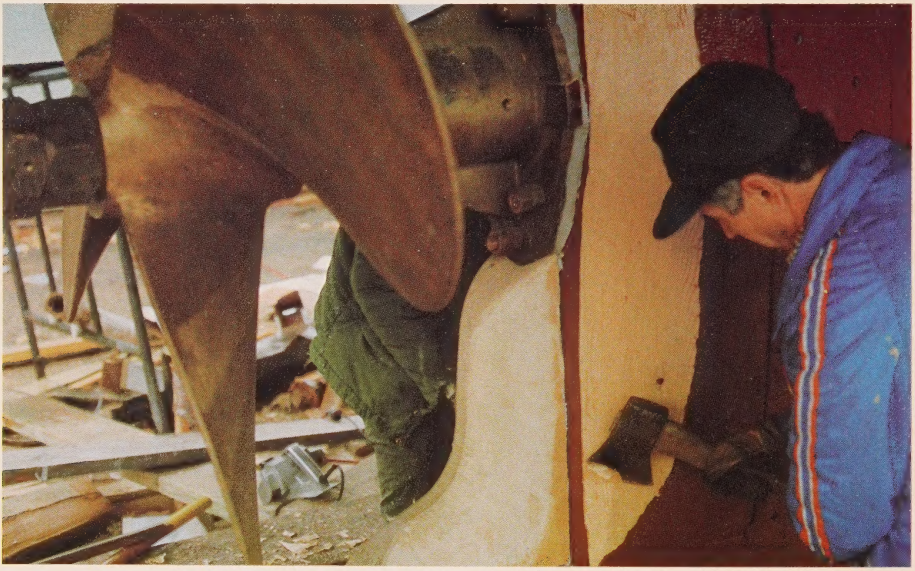
The effect is soon seen on the blades. Performance decreases and the blade wears out. Cavitation is a common and costly problem for many vessel owners.

Remedies for cavitation

The two main solutions to cavitation are to run your vessel at lower R.P.M. or increase the surface area of your blades. This can be done through installing a prop with wider blades or more blades, or if the aperture permits, a large diameter. Make sure though you maintain recommended clearances or you may create other problems.

Other propeller problems

- Chips, nicks, rough blade surfaces, reduce propeller efficiency more than you think. **Take care.**
- Large square stern posts and other protruding appendages affect the flow of water into the blades. **Fair away.**
- Barnacles and marine growth slow you down. You don't need these extra passengers. **Scrape them away.**
- Poor propeller shaft alignment will reduce efficiency. **Check periodically.**



Variable pitch propellers

A dragger alternates between free running and towing. The prop must be pitched somewhere between the extremes of these operating needs. It must be coarse enough to give a fair running speed yet fine enough to drag a heavy net at a slow speed. Again, it's a matter of compromise. There are however, other possibilities. A two pitch propeller will give as the name implies, two pitches — a fine pitch for towing, a coarse pitch for steaming.

A multi-pitch or as its often called, a variable or controllable pitch propeller enables the skipper to change to whichever pitch he needs. The blades are adjustable either mechanically or hydraulically. Two pitch and multi-pitch propellers are used extensively by deep sea vessels and in Europe by the inshore fishing fleets. So far most Canadian inshore fishermen have been reluctant to invest. They've been wary of the high initial cost and the possible difficulties of maintenance and repair work.

However, such propellers have distinct advantages, particularly for varied fishing operations where there's a need for operational flexibility.

Nozzles for inshore dragging

One way to increase thrust on a fixed pitch propeller is to install a nozzle. This is a ring which fits on over the propeller to help increase the forward thrust. The aerofoil design of the ring accelerates the flow of water and the resulting pressure difference produces an added "lift" and push forward.

All this translates into an extra thrust of some 25-30% for the same R.P.M.. It means a dragger can tow a bigger net, or keep the same net and save on fuel by towing at lower R.P.M..

It's difficult to install a nozzle over an existing propeller. To work properly within a nozzle, a blade must be of a special shape, and have a very small clearance. It's a job for the specialist. While the initial costs are obviously higher, the savings in fuel and the increased efficiency result in considerable savings.

Inshore dragger fishermen on the Atlantic Coast are beginning to use nozzles. Talk it over with them and consider.

Power and Fuel Economy — It's worth thinking about.

A final word

Lack of care in propeller selection and maintenance have resulted in the loss of countless millions of dollars to Atlantic Coast fishermen over the years. This booklet is the beginning of an effort to eliminate this needless waste. It's an attempt to make fishermen aware of the basic principles of propeller design and performance.

Learn what you can about propellers. Consult with the experts. Take care in selecting the best possible propeller for your vessel and your fishing needs.

Remember, no matter how beautiful the hull, – no matter how powerful the engine, your vessel is really no better than the blades that push her along.

Take care when the time comes to "Pick a Prop".

Notes

Fisheries and Oceans

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